

**Passively characterizing and tracking sporadic E using radio emission from  
the electrical grid  
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We show that sporadic E can be passively characterized, where the unintentional human-made radio emissions from overhead power lines act as an illumination source. The widespread nature of power-lines in North America enables the Long Wavelength Array (LWA) radio telescopes to geolocate and track sporadic E over a large region of a few hundred km radius of their location in New Mexico. We present observations that show the emissions originate from micro-arcs on power lines, where the emission is comprised of many short broadband bursts in the high frequency (HF; 3 – 30 MHz) and Very High Frequency (VHF; 30 – 300 MHz) bands that repeat at a cadence of 120 Hz, which is twice the grid operating frequency in North America.

The geometry of the observations rule out contributions from field aligned scatter, which implies propagation by simple reflection from over dense plasma. We show that the brightest emissions originate in the direction of large metropolitan centers at distances between 700 and 1250 km, but rural regions in this distance range contribute emissions to enable continuous tracking over hundreds of km. With two LWA stations in New Mexico, we are able to geolocate specific sporadic E structures and track their movements with time. The broadband nature of power line emission enables measurements of the maximum usable frequency (MUF). Combining the MUF with geolocation we can then estimate of the peak plasma frequency and therefore the electron density. We note that on rare occasions plasma frequencies have been observed above 30 MHz.